scientific reports

Check for updates

OPEN

Factors associated with post-traumatic stress symptoms in healthcare providers after performance of cardiopulmonary resuscitation: a mixed-methods study

Myeong Namgung[1,2], Il Youp Kwak[3] & Chan Woong Kim[4,5]✉

The experience of performing cardiopulmonary resuscitation (CPR) can cause post-traumatic stress symptoms that negatively impact healthcare providers and reduced their clinical competency. This two-phase mixed-methods was conducted to investigate the factors that cause post-traumatic disorder (PTSD) in healthcare providers who perform CPR. Phase 1 included a survey with a trauma screening questionnaire (TSQ). Phase 2 included gathering interview data and applying conventional content analysis to identify themes. Of the 286 medical staff who completed the TSQ, 32 (11.2%) of respondents experienced PTSD after administering CPR. PTSD occurred significantly more frequently in nurses than in doctors. Among nurses, those with 2–5 years of experience were the most likely to experience PTSD. From the content analysis of the interview data, four themes with twelve subthemes emerged: Healthcare providers were not prepared for CPR, Difficulties faced during CPR administration, Negative emotions experienced after performing CPR, and Overcoming stress and moving forward. The occurrence of PTSD is associated with negative experiences in each stage of the event: before-, during-, and after-CPR. Therefore, to avoid or overcome PTSD caused by performing CPR, systematic and customized intervention strategies suitable for each stage of the process are needed.

Keywords Cardiopulmonary resuscitation (CPR), Post-traumatic stress disorder (PTSD), Healthcare providers

Post-traumatic stress disorder (PTSD) is an extreme psychological stress reaction that occurs after direct experience of or witnessing traumatic events such as wars, disasters, and terror[1]. It is characterized by symptoms such as re-experiencing the traumatic events, avoidance of trauma-related stimuli, hyperarousal symptoms (irritability, concentration difficulties, sleep disorders), and negative cognitions and mood[2]. PTSD can disrupt social behavior, eventually leading to adjustment disorders in professional and personal lives[3].

Although the traumatic events that cause PTSD mainly include war, traffic accidents, exposure to violence, and sexual assault[4], witnessing a patient in cardiac arrest and performing cardiopulmonary resuscitation (CPR) can also cause post-traumatic stress symptoms (PTSS)[5–15]. Most previous studies on PTSS after performing CPR focused on lay rescuers and relatives of cardiac arrest patients. Families who witness non-resuscitated patients in cardiac arrest exhibited PTSD symptoms approximately twice as often as non-witnesses[5]. Zijlstra et al. reported

[1]Department of emergency medicine, College of Medicine, Chung-Ang University, 84 Heukseok-ro, Dongjak-gu, 06974, Seoul, Republic of Korea. [2]Emergency Medicine, Chung-Ang University Gwangmyeong Hospital, 110 Deokan-ro, Gwangmyeong-si 14353, Gyeonggi-do, Republic of Korea. [3]Department of Applied Statistics, College of Business & Economics, Chung-Ang University, 84 Heukseok-ro, Dongjak-gu, 06974 Seoul, Republic of Korea. [4]Department of emergency medicine, College of Medicine, Chung-Ang university, 84 Heukseok-ro, Dongjak-gu, 06974, Seoul, Republic of Korea. [5]Emergency medicine, Chung-Ang University Hospital, 102 Heukseok-ro, Dongjak-gu, 06973 Seoul, Republic of Korea. ✉email: whenever@cau.ac.kr

that approximately 60% of lay rescuers who performed bystander CPR suffered short-term psychological impact, and 19% showed trauma-related stress symptoms 4–6 weeks later[6].

On the other hand, there are few studies investigating the PTSS that occur in healthcare provider after they have performed CPR[9,11,13,16,17], and most of those studies simply reported the incidence of trauma symptoms they experienced[11,13,16,17]. Although Spencer et al. reported that junior doctors were more likely to experience trauma symptoms than nurses or more senior doctors[9], studies on factors associated with occurrence of PTSS after performing CPR among healthcare providers is still lacking. PTSD among medical staff negatively impacted individuals and reduced their clinical competency and quality of patient care[18]. Therefore, it is important to evaluate the factors that cause PTSS among medical staff who performing CPR to avoid or overcome that. In this study, we investigated factors related to PTSS among healthcare providers who have administered CPR, using survey and interview methods.

Methods

This single center study was conducted in 785-bed tertiary hospital located in Seoul, South Korea. This study used two phase mixed-methods study design; phase 1 was a survey and phase 2 was a qualitative interview study. This study was approved by the Institutional Review Boards of Chung-ang university (IRB No. 2160-004-464) and performed in accordance with the Declaration of Helsinki. The informed consent was obtained from all participants.

Phase 1: survey study

A mobile link of the questionnaire was sent using *SurveyMonkey*™ to all the medical staff working in the selected hospital (424 doctors and 857 nurses). The questionnaire consisted of three sections and 22 items, which comprised demographics items, trauma screening questionnaire (TSQ), and experiences that caused the traumatic symptoms. The TSQ consists of ten questions covering reactions that occur after a traumatic event, and respondents are asked to indicate (Yes/No) whether or not they have experienced the reactions at least twice in the past week[19]. It is a validated screening tool for PTSD with a sensitivity of 0.85 and a specificity of 0.89[20]. A TSQ score of six or more is judged as a positive indicator of PTSD. However, because the aim of this study is to investigate trauma symptoms and as well as PTSD, having a TSQ score of one or more was defined as indicating trauma symptoms. Therefore, we first analyzed those who answered "yes" to one or more items as "Post-traumatic stress symptoms (PTSS)" group and further analyzed those who answered "yes" to six or more items as "Probable PTSD" group.

Survey responses were statistically analyzed using R software (version 4.1.2). Categorical variables are presented as percentages. The chi-square test was used to compare the differences in proportions between characteristics within the PTSS group and probable PTSD group, respectively. Fisher's exact test was used for groups with a frequency of five or less. P-value<0.05 was considered statistically significant at the 95% confidence interval.

Phase 2: qualitative interview study

Interviewees were recruited from among PTSS group. Interviews were conducted with only those who voluntarily agreed to participate, and recruitment was stopped when the data reached saturation. The interviews lasted 30–60 min and used semi-structured methods. First, interviewees were asked to talk about their experiences with CPR that caused PTSS. The following questions were asked in the interview: (1) What type of patient was it?; (2) How long have you been performing CPR?; (3) Was the patient successfully resuscitated?; (4) How did you feel after performing CPR?; (5) What did you do to address trauma symptoms?

All interviews were recorded and transcribed verbatim by a researcher who did not conduct content analysis. Subsequently, two authors (C.W.K. and M.N.) repeatedly read and analyzed the transcribed texts using conventional content analysis to extract themes[21]. When the opinions of the two researchers were inconsistent, an agreement was reached through sufficient discussion.

Results

Survey study

Of the 305 healthcare providers (77 doctors and 228 nurses) who responded to the questionnaire, 286 completed the TSQ. Among the 286 respondents, the PTSS group comprised 178 respondents (62.2%) and the probable PTSD group 52 respondents (18.2%). Of those who responded that CPR was a traumatic event, 115 (40.2%) were in PTSS group and 32 (11.2%) in probable PTSD group. In the probable PTSD group, wherein the participants were positive for PTSD as per the diagnostic screening test, the odds ratio between developing PTSD due to CPR and events other than CPR was 3.02 (p-value < 0.05).

The trauma symptoms after administering CPR occurred significantly more frequently in nurses than in doctors, in both the PTSS (75.7%vs. 24.3%, $p = 0.049$) and probable PTSD groups (90.6% vs. 12.5%, $p = 0.013$). Regarding trauma symptoms occurrence, there was no difference according to the title held by the doctors; however, there was a statistical difference according to the nurses' years of experience. Nurses with 2–5 years of experience were most likely to experience trauma symptoms after performing CPR in both the PTSS (35.6%, $p < 0.05$) and probable PTSD groups (48.3%, $p < 0.05$). The total number of CPRs performed and locations where they were performed were significantly different only in the PTSS group ($p = 0.045$ and 0.031, respectively). In the PTSS group, those who performed CPR more than ten times comprised the largest group (64.3%), whereas those who performed CPR only once, comprised the fewest group (7.0%). The most common location where CPR was performed was the general ward (36.5%), followed by the emergency room (13.0%; Table 1).

	TSQ score = 0 (n = 95)	TSQ score ≥ 1 (n = 115)	p-value†	TSQ score ≥ 6 (n = 32)	p-value‡
Role, n (%)			**0.049**		**0.013**
Doctor	35 (36.8)	28 (24.3)		4 (12.5)	
Nurse	60 (63.2)	87 (75.7)		29 (90.6)	
Title of doctor, n (%)			0.846		0.691
Intern	16 (45.7)	14 (50.0)		1 (25.0)	
Resident	16 (45.7)	11 (39.3)		3 (9.4)	
Specialist	3 (8.6)	3 (10.7)		0 (0.0)	
Career of nurse, n (%)			0.881		0.8284
< 1year	2 (3.3)	1 (0.9)		0 (0.0)	
1–5 years	17 (28.3)	31 (27.0)		10 (31.3)	
6–10 years	9 (15.0)	17 (14.8)		7 (21.9)	
11–15 years	12 (20.0)	18 (15.7)		7 (21.9)	
16–20 years	8 (13.3)	15 (13.0)		4 (12.5)	
> 20 years	11 (18.3)	5 (4.3)		1 (3.1)	
No response	0 (0.0)	0 (0.0)		0 (0.0)	
Total number of CPR, n (%)			**0.045**		0.831
1	1 (1.1)	8 (7.0)		1 (3.1)	
2–5	14 (14.7)	16 (13.9)		6 (18.8)	
6–10	24 (25.3)	16 (13.9)		6 (18.8)	
> 10	56 (8.9)	74 (64.3)		19 (59.4)	
No response	0 (0.0)	1 (0.9)		0 (0.0)	
Location, n (%)			**0.031**		0.960
General ward	35 (58.3)	42 (36.5)		15 (46.9)	
Outpatient clinic	2 (3.3)	11 (9.6)		3 (9.4)	
Emergency room	5 (8.3)	15 (13.0)		3 (9.4)	
Intensive care unit	15 (25.0)	12 (10.4)		6 (18.8)	
Others	3 (5.0)	7 (6.1)		2 (6.3)	
No response	0 (0.0)	0 (0.0)		0 (0.0)	

Table 1. Factors related to trauma symptoms after performing CPR. All data are presented as number (%). † The Chi-square tests were performed between without traumatic symptoms group (TSQ = 0) and the PTSS group (TSQ score ≥ 1). ‡ The Chi-square tests were performed between the without traumatic symptoms group (TSQ score from 0 to 5) and the probable PTSD group (TSQ score ≥ 6). TSQ : trauma screening questionnaire, CPR: cardiopulmonary resuscitation.

Most people with trauma symptoms responded that they endured them without taking any special action (44.5%), talked to acquaintances such as family, friends, and colleagues, (44.5%), or took a break from work (29.7%; Fig. 1). Even in the probable PTSD group, only one participant answered that they had consulted an expert.

Qualitative interview study

Eight healthcare providers (two doctors and six nurses), participating in this study, were interviewed regarding their experiences of administering CPR that caused them to develop trauma symptoms. Following the content analysis, four themes with twelve subthemes emerged (Table 2).

1) Healthcare providers unprepared for CPR.

The participants responded that they experienced trauma symptoms after they performed CPR in unexpected situations, such as when the patient's condition before the cardiac arrest occurred was relatively stable or when the cardiac arrest was not immediately recognized and discovered at a later stage. In addition, most participants reported that they had not received proper CPR training, had little actual experience, and had not performed CPR for a long time.

1.1) Unexpected cardiac arrest

Participant 1: The patient was in an isolation room. The monitor was not working, so I went to check and found that the patient was in cardiac arrest. No one knew for how long he was in that state.

Participant 2: The patient came just to check if his coronary arteries were okay or not. So, I was under the impression that it would be over soon, but as soon as the intervention started, a sudden cardiac arrest occurred…I performed CPR without any preparation.

1.2) Absence of proper CPR training

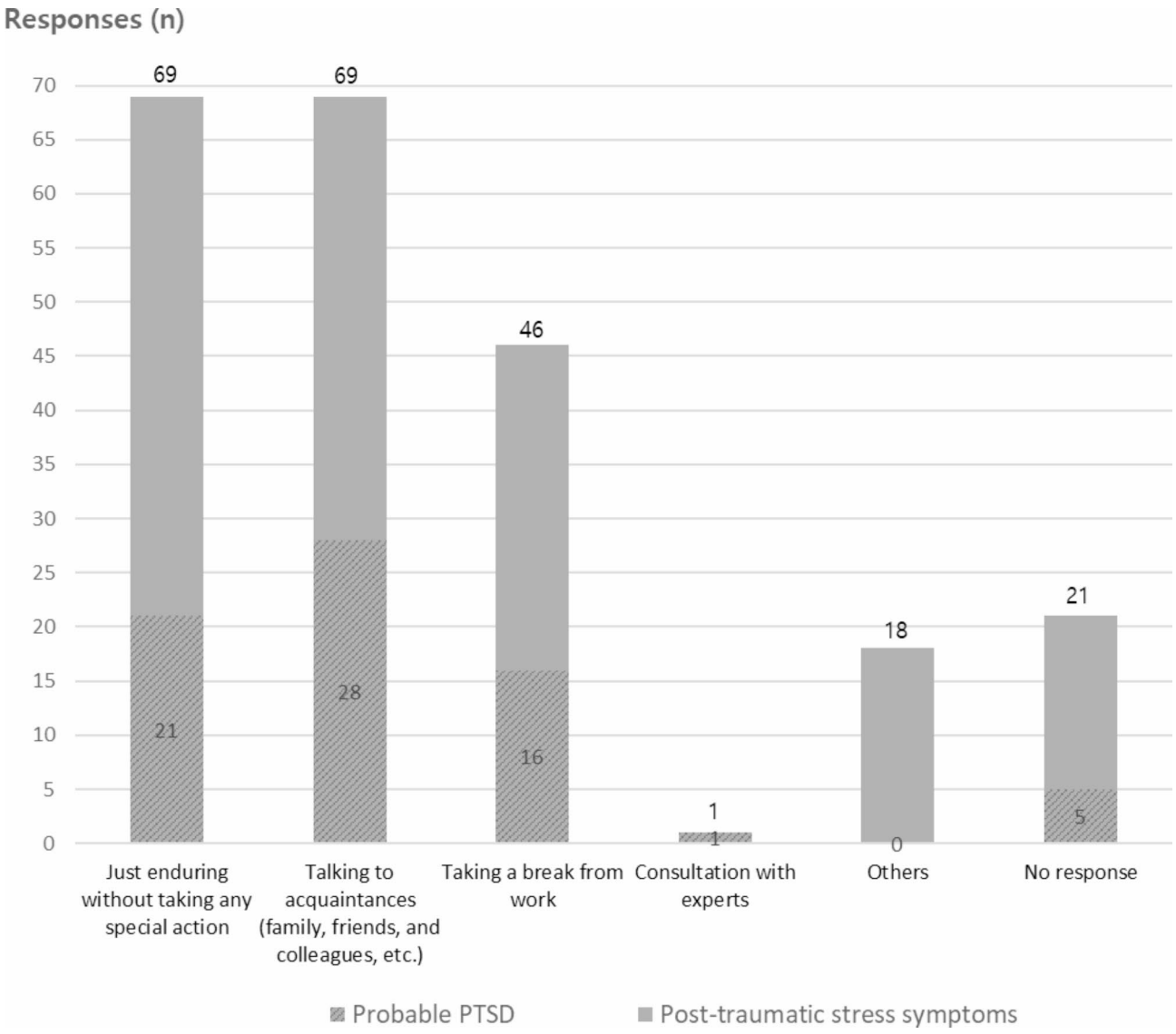

Fig. 1. Measures reported by the participants to address trauma symptoms (multiple responses were possible).

Themes	Subthemes
Healthcare providers unprepared for CPR	Unexpected cardiac arrest
	Absence of proper CPR training
	Lack of CPR experience
Difficulties faced during performing CPR	Not performing their role properly
	Shortage of CPR providers
	The patient's morphology is unsightly
	Skepticism about continuing meaningless CPR
Negative emotions after performing CPR	Guilt towards the patient's family
	Blaming themselves
	Fear of re-experiencing
Overcoming stress and moving forward	Providing better care of patients
	Debriefing on CPR helps to overcome stress

Table 2. The themes and subthemes.

Participant 1: There is no training in neonatal CPR at the hospital. I just learn from experience, study on my own, or listen to the preceptors. That is all.

1.3) Lack of CPR experience

Participant 2: I was doing CPR for the first time. So, I could not prepare the medicine properly because my hands were shaking.

Participant 7: Since this is only my second CPR, I do not know what to do.…

2) Difficulties faced during CPR administration.

The participants responded that they experienced trauma symptoms when faced with several difficulties during CPR. They felt that the CPR process was very difficult when they could not perform their roles properly or lacked manpower. Furthermore, they stated that it was difficult to see patients who were vomiting blood or had broken ribs. They were also skeptical when they continued to perform meaningless CPR on a patient with less likelihood of resuscitation.

1.1) Not performing their role properly

Participant 1: The professor came and asked whether the blood test had been done; I had not done it. I only checked the patient's pulse and saturation, and then I measured blood pressure, did a blood test, and gave bicarbonate.…

Participant 6: Another nurse gave epinephrine, not intravenously but intra-arterially. The blood was flowing backward, but she was flushing by giving epinephrine.

1.2) Shortage of CPR providers

Participant 2: I think it was overwhelming because I had to make all the ECMO preparations, priming, intubation, and drugs by myself. I had too many things to do.…

1.3) The patient's morphology is unsightly

Participant 4: I still cannot forget the image of the patient's ribs breaking and him vomiting blood during CPR. And the patient was also undressed.

Participant 6: A lot of blood came out while suctioning, but the smell was so disgusting. When I came home and washed my body, the smell of blood kept coming into my nose, blood was all over my body, and there was blood all over the sheets and floor… that later appeared in my dream.

1.4) Skepticism about continuing meaningless CPR

Participant 4: I thought it would be better not to do CPR for so long.

Participant 5: Most cardiac arrest people do not get resuscitated, or even if they do, their quality of life is very poor. So I had a lot of doubts about whether I should do CPR. I think that if I had a cardiac arrest, I would never want to receive CPR.

3) Negative emotions after performing CPR.

The participants suffered from negative emotions such as guilt toward the patient's family for not being able to save the patient's life, self-blame over whether the patients might have survived if they had done better or if someone else had performed CPR, and fear of experiencing a similar CPR situation again.

1.1) Guilt toward the patient's family

Participant 2: First of all, I felt sorry for the family. They trusted us and entrusted the patient to us, but he passed away after not being properly treated. They kept crying… The professor was explaining, but they just cried… I was so sorry.

1.2) Blaming themselves

Participant 3: Although she was in distress, I thought she would be able to endure it because she was young. I think I was greatly mistaken…I think she might have survived if she had been treated by someone other than me.

Participant 8: In fact, there is such a thing as guilt that I wish I had done better when intubating him at that time and given him a little more oxygen.

1.3) Fear of re-experiencing

Participant 5: Every time I went to work, I felt very burdened that the patient would get worse. When CPR is required, even if a helper comes from other wards, I think there is anxiety that the patient is getting worse.

Participant 7: When patients of the same age or with similar diagnoses were hospitalized, it was a bit… I think there was something frightening about it for no reason…It was mentally difficult to cope with an emergency like this, and I thought a lot that my skills were not so good.

4) Overcoming stress and moving forward.

The participants responded that after overcoming trauma symptoms, they paid more attention to their patients and made more efforts to take better care of them than before experiencing trauma symptoms. And they reported debriefing after CPR was helpful in overcoming trauma symptoms.

1.1) Providing better care to patients

Participant 7: There are a lot of bedridden people. I did not pay much attention to their mental status before, but recently, I think I pay more attention to them. In some ways, it may have been an opportunity for me to do better nursing.…

1.2) Debriefing on CPR helps to overcome stress

Participant 2: Talking about CPR, such as "This could have happened because of this," or" I wish it had happened sooner," etc. helps prepare for the next CPR.

Discussion

This study found that approximately 20% of health care providers experienced trauma symptoms severe enough to test positive for PTSD on the TSQ while still working in a hospital. Among them, 11.2% of respondents experienced PTSD after performing CPR, similar to the 9.6% reported by Spencer et al.[9], but, is much lower than the 28% reported by Kolehmainen et al.[17]. In addition, the prevalence of PTSD after performing CPR was three times higher than after events other than CPR. This suggests that performing CPR itself is likely to cause PTSD in healthcare providers. Furthermore, the qualitative analysis confirmed that CPR is experienced by healthcare providers as a series of processes, including the occurrence of cardiac arrest (before-CPR), performing CPR (during-CPR), and procedures after CPR (after-CPR). A negative experience at any of these stages influenced the development of PTSD after CPR, and the factors associated with the negative experiences different for each healthcare provider at each stage.

In this study, factors associated with the occurrence of PTSD due to events before administering CPR are unexpected cardiac arrest and a lack of knowledge or experience with CPR. In survey, trauma symptoms after performing CPR occurred more often in nurses than in doctors, and there was no statistical difference in the prevalence of trauma symptoms according to the titles held by doctors. These results differ from those of Spencer et al. that inexperienced doctors have a higher risk of PTSD than nurses or more experienced doctors[9]. This may have been because of the smaller number of doctors included in our analysis. In our study, more than half the doctors were interns in the PTSS group. As the number of participants analyzed increases, it is expected that inexperienced doctors will show a higher risk of PTSD than more experienced doctors. By contrast, trauma symptoms after performing CPR occurred most frequently when providers had more than ten CPR experiences. Since trauma symptoms after performing CPR can occur even in healthcare providers with extensive CPR experience, it seems that performing more CPR increases the chance of experiencing trauma symptoms. Previous studies have also shown that frequency of exposure to traumatic events is related to the occurrence of PTSD[22,23]. Additionally, trauma symptoms occurred most frequently when CPR was performed in a general ward, which was also related to the before-CPR factors. As most patients in general wards are in relatively good condition and are less monitored, it is difficult to predict the occurrence of cardiac arrest, and people working in general wards are less familiar with CPR than the healthcare providers in the emergency room or intensive care unit.

Improperly performed procedures by themselves or their team, CPR scenes with an unsightly patient, and continuing meaningless CPR were identified as factors for during-CPR that are associated with the occurrence of trauma symptoms. In the interviews, participants mentioned mistakes made by them or other team members while performing CPR and continuing meaningless CPR as stressful. A previous study of the effect of CPR on doctors' stress also reported that inappropriate CPR without "do not resuscitate" orders was the second-most common cause of stress[24]. Ultimately, this led to negative feelings such as guilt toward the patient's family, self-blame, or fear of re-experiencing after performing CPR.

Although coping behaviors such as denial and self-blame are known to be strongly associated with PTSD[11], they can help healthcare providers improve as medical professionals, if they are able to overcome the associated negative emotions. In the interviews, participants said that the experience of overcoming PTSD caused by performing CPR motivated them to pay more attention to patients and strive to provide better care. This is similar to a previous study on emergency department nurses' experiences of performing CPR, which reported improved expertise in the participants[13]. Dealing with the negative emotions after performing CPR is important for preventing the development of PTSD. However, healthcare providers who experience trauma symptoms after CPR were not provided with appropriate care to cope with trauma symptoms. In our survey, most of the participants overcame it alone without expert assistance. Emotional and social support from colleagues was reported to be effective in preventing occurrence of trauma symptoms[23]. Therefore, it seems helpful to provide institutional emotional support from colleagues to overcome PTSD including expert consultation.

Limitations

This study has several limitations. First, the overall sample size of survey study was small with the total number of subjects is 305. We calculated the target number of subjects with to be 296 with 95% confidence level and 5% margin of error and tried to obtain the minimum representativeness by recruiting more respondents than the target number. However, the generalizability of the results may still be limited. Second, there is a possibility of recall bias regarding past memories because this was a study of a trauma event that had already been experienced. Finally, only eight were interviewed in this study, which may limit the range of perspectives explored. Although data saturation of qualitative study was reached, future studies should consider interviewing more healthcare providers.

Conclusion
Performing CPR can cause trauma symptoms among healthcare providers working in hospitals. The occurrence of trauma symptoms after administering CPR is associated with various factors from before, during, or after CPR performance. Trauma symptoms can affect any medical staff performing CPR if a problem occurs in any part of the series of processes. Therefore, to prevent or overcome trauma symptoms after performing CPR, systematic and customized intervention strategies suitable for each process are needed.

Data availability
The datasets generated or analysed during the current study are available from the corresponding author on reasonable request.

Received: 28 May 2024; Accepted: 20 January 2025
Published online: 27 January 2025

References
1. Qi, W., Gevonden, M. & Shalev, A. Prevention of post-traumatic stress disorder after trauma: current evidence and future directions. *Curr. Psychiatry Rep.* **18** (2), 20 (2016).
2. *American Psychiatric Association: Diagnostic and Statistical Manual of Mental Disorders, 5th Edition. Arlington, VA*. (2013).
3. Auxéméry, Y. Post-traumatic psychiatric disorders: PTSD is not the only diagnosis. *Presse Med.* **47** (5), 423–430 (2018).
4. Sareen, J. Posttraumatic stress disorder in adults: impact, comorbidity, risk factors, and treatment. *Can. J. Psychiatry*. **59** (9), 460–467 (2014).
5. Compton, S. et al. Post-traumatic stress disorder symptomology associated with witnessing unsuccessful out-of-hospital cardiopulmonary resuscitation. *Acad. Emerg. Med.* **16** (3), 226–229 (2009).
6. Zijlstra, J. A. et al. Psychological impact on dispatched local lay rescuers performing bystander cardiopulmonary resuscitation. *Resuscitation* **92**, 115–121 (2015).
7. Clohessy, S. & Ehlers, A. PTSD symptoms, response to intrusive memories and coping in ambulance service workers. *Br. J. Clin. Psychol.* **38** (3), 251–265 (1999).
8. Stassart, C. et al. Psychological impact of out-of-hospital cardiopulmonary resuscitation (CPR) on the witness engaged in gestures of survival]. *Rev. Med. Liege*. **72** (5), 236–240 (2017).
9. Spencer, S. A. et al. The presence of psychological trauma symptoms in resuscitation providers and an exploration of debriefing practices. *Resuscitation* **142**, 175–181 (2019).
10. Soleimanpour, H. et al. Psychological effects on patient's relatives regarding their presence during resuscitation. *J. Cardiovasc. Thorac. Res.* **9** (2), 113–117 (2017).
11. McMeekin, D. E. et al. Stress and coping of critical care nurses after unsuccessful cardiopulmonary resuscitation. *Am. J. Crit. Care*. **26** (2), 128–135 (2017).
12. Mathiesen, W. T. et al. Reactions and coping strategies in lay rescuers who have provided CPR to out-of-hospital cardiac arrest victims: a qualitative study. *BMJ Open.* **6** (5), e010671 (2016).
13. Lee, M. R. & Cha, C. Emergency department nurses' experience of performing CPR in South Korea. *Int. Emerg. Nurs.* **38**, 29–33 (2018).
14. Celik, C., Celik, G. S. & Buyukcam, F. The witness of the patient's relatives increases the anxiety of the physician, but decreases the anxiety of the relatives of the patient. *Hong Kong J. Emerg. Med.* **28** (6), 338–345 (2021).
15. Axelsson, A. et al. Factors surrounding cardiopulmonary resuscitation influencing bystanders' psychological reactions. *Resuscitation* **37** (1), 13–20 (1998).
16. Morgan, R. Survey of junior hospital doctors' attitudes to cardiopulmonary resuscitation. *Postgrad. Med. J.* **78**, 413–415 (2002).
17. Kolehmainen, C. et al. Post-code PTSD symptoms in Internal Medicine residents who participate in cardiopulmonary resuscitation events: a mixed methods study. *J. Grad Med. Educ.* **7** (3), 475–479 (2015).
18. Einav, S. et al. Differences in psychological effects in hospital doctors with and without post-traumatic stress disorder. *Br. J. Psychiatry*. **193** (2), 165–166 (2008).
19. Brewin, C. R. et al. Brief screening instrument for post-traumatic stress disorder. *Br. J. Psychiatry*. **181**, 158–162 (2002).
20. Walters, J. T., Bisson, J. I. & Shepherd, J. P. Predicting post-traumatic stress disorder: validation of the Trauma Screening Questionnaire in victims of assault. *Psychol. Med.* **37** (1), 143–150 (2007).
21. Moser, A. & Korstjens, I. Series: practical guidance to qualitative research. Part 3: Sampling, data collection and analysis. *Eur. J. Gen. Pract.* **24** (1), 9–18 (2018).
22. Kim, S. J. & Yeo, J. H. Factors affecting posttraumatic stress disorder in South Korean trauma nurses. *J. Trauma. Nurs.* **27** (1), 50–57 (2020).
23. Adriaenssens, J., de Gucht, V. & Maes, S. The impact of traumatic events on emergency room nurses: findings from a questionnaire survey. *Int. J. Nurs. Stud.* **49** (11), 1411–1422 (2012).
24. Morgan, R. & Westmoreland, C. Survey of junior hospital doctors' attitudes to cardiopulmonary resuscitation. *Postgrad. Med. J.* **78** (921), 413–415 (2002).

Acknowledgements
The study was conducted with the support of the 2022 Health Fellowship Foundation.

Author contributions
Conception and Design: MN, CK; Acquisition and Analysis: IK; Interpretation of data: MN, CK; Writing original draft and revising: MN. All authors read and approved the final manuscript.

Declarations

Competing interests
The authors declare no competing interests.

Additional information
Correspondence and requests for materials should be addressed to C.W.K.